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Energy Alberta 1991

Energy Resources Conservation Board
Review of Alberta Energy Resources in 1991

ABEL Janet • ABEL Terry • ABBOTT, Rosemary • ABRAM Wes • ADOLF Cheryl • AGNEW Dave • ALDRIDGE Joan • ALLEN Tony • ALWAST Norbert • AMORUSO Joe • ANGRAVE Paul • ANTOLIN Violet • ANTON Doug • ASGAR-DEEN Mike • AULD Bruce • AUSTIN Brenda • BADER Wes • BAHADUR Ken • BAHNSEN Byron • BAKER Pat • BAKER Dave • BALES Jack • BAMBURY Pat • BANISTER Ken • BANTA Darrold • BARBER Murray • BARBER Rob • BARCLAY Shelley • BARKLEY Brenda • BARNES Nancy • BARNETT Ted • BARON Sheila • BARTEK Jiri • BARTLETT Dan • BATES Teresa • BATKE Lisa • BATTEN Dick • BAU Andrew • BEAMER Don • BEATON Randy • BECK Sherry • BEGG Gordon • BEKEN Ali • BELANGER Sherry • BELANGER Betty Jean • BELL Joanne • BENNETT Colin • BENONS Pat • BENUM Jim • BENWELL George • BERG Wayne • BERGE Sharon • BERNDTSSON Guy • BEYEA Terry • BIETZ Brian • BIRD Douglas • BOBER Walter • BONNER Elaine • BOONE Darlene • BORDING Bob • BORZEL Bob • BOTHWELL Paul • BOULTON Susan • BOYD Barry • BOYD Evelyn • BRADFORD Kim • BRADY Debbie • BRADY Joan • BRADY Suezan • BRAGANZA Jude • BRAUN Rollie • BRAUNMULLER Gwen • BRAY Marianne • BRAY Eileen • BROSINSKY Glen • BROTHEN Sharon • BROWN David • BRUECKNER Beth • BRUNI Mike • BRUNSCH Berni • BUECHLER Doug • BURES Meg • BURKE Rita • BURMAN Helen • BURNSIDE Bob • BURROWES Andy • BYRNES Tom • CADICK Ruth • CAIRNS Mary Anne • CALIHOO Rob • CAMPANELLI Anna • CAPPER Lillian • CARMICHAEL Marjorie • CARR Randy • CARROLL Margaret • CARTER Glenda • CASSIDY Crystal • CASSLEY Alan • CASTILLO Arly • CHAMBERLAIN Brian • CHAN Tom • CHARE Al • CHARLEBOIS Sharon • CHARLESWORTH Ron • CHECALOSKI Don • CHIASSON Wayne • CHRISTENSEN Barry • CHRISTIANSEN Terry • CHRISTIE Brenda • CLARK Eileen • CLARKE Bea • CLEATOR Charlene • CLYDE Vern • CONNELLY Marnie • CONROY Kevin • COOK Abby • COOK Tom • COOK John • COOTE Kelly • CORDERY Mary Ann • CORMACK Rob • COULL Olga • COWITZ Susan • COX Rob • CRAIG Marilyn • CRAIG Rob • CREASEY Roger • CREWSON Stephen • CROUCH Kerrie-Lynn • CROWE Kevin • CULLEN Herb • CUPIDO Peter 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Leslie • FISHER Karine • FLEGG Eileen • FLEMING Lynda • FLORENCE Roger • FLYNN Rozita • FORBES Paul • FORSCH Elaine • FORTIER Rick • FOX Ed • FOX Verona • FRANCHUK Judy • FRANDLE Lorraine • FRASER Dave • FREDLUND Lorne • FRENCH Wendy • FRIZZELL Janet • FROESE Loreen • FROST Bernie • FUHRMAN Lorraine • GALLANT Brenda • GARDINER Ian • GARVIN Darcy • GEDDES Kent • GEE Emily • GEERTSEN Troy • GEIS Paulette • GEMS Doris • GERWING Lois • GILES Doug • GLADWYN Keith • GOLD Maureen • GOMBERT Ursula • GORMLEY Joe • GOULDING Larry • GOWAN Richard • GRAHAM Don • GRANT Sharon • GREEN Wayne • GREGORY Don • GREIG Richard • GREIN Janet • GREWAL Sukh • GREWAL Sukh • GROEN Hellen • GROSSBERNDT Ben • GROVER Lorraine • GRUNDAHL Pat • GUILD Sandy • GULAMHUSEIN Nadia • GULJAS Andy • HABIB Georgette • HADI Zawher • HAISTE Reba • HALARI Habiba • HALL Garnet • HALLA Susan • HALLADAY Harvey • HALLETT Kathy • HALVERSON Tammi • HAND Janice • HARDING Duane • HARDMAN Holly • HARNACK Sheila • HARRIPERSAD Joan • HARRISON Brent • HARTY Kirsten • HARTY Kirsten • HASKAYNE Bruce • HASS Darryl • HAUSER Rolf • HAY Pam • HAY Blair • HAYNES Airaca • HEGGIE Bob • HENDERSON Dave • HENNESSEY Don • HENSON Rock • HETTINGA Bert • HEWITT Phil • HILL Dave • HILL Val • HILL Cal • HIRD Laura • HIRJI Mumtaz • HLADIK Marcus • HOEY Sam • HOFER Joseph • HOLCAK Karla • HOLIZKI Lynda • HOLLAND Mike • HOLLYWOOD Dale • HOLMGREN Ralph • HOMENIUK Fred • HOREL Eileen • HORNE Tracy • HOUGHTON Ron • HOULIHAN Richard • HOWLAND Doug • HRYNUIK Brenda • HUBBARD Brad • HUBBARD Kathy • HUBENSKY Dawn • HUBENSKY Dawn • HULBERT Gord • HUNGAR Shirley • HUNT Ken • HUNTER Sarah • HUOT Lynda • HURST Terry • HURTUBISE Guy • HUTCHINSON Linda • IVERSEN Moira • JACOBS Margo • JAMAL Yasmin • JAMES Norm • JAMIL Khalid • JENKINS Valerie • JENKINSON Graham • JEPPS Lisa • JEPPS Arthur • JOBANPUTRA Manju • JOBIN Mark • JOHNSON Kerry • JOHNSON Cindy • JOHNSON Albert • JOHNSON Heather • JOHNSON Liz • JOHNSTON Kevin • JURADO Emily • KACZKOWSKI Jean • KAHLER Paul • KAN Sally • KAR Ratan • KARDELIS Kevin • KARMALI Alnoor • KARMALI Anil • KARMAN Susan • KASSAM Gulshan • KASSAM Shahenaz • KEELAN Tom • KELEMEN Sandy • KELLY Michele • KELSICK Annetta • KEMLO Donna • KENDRICK Kirby • KENNEDY Peggy • KENNEDY Carol • KENNEDY Mike • KEUSHNIG Harold • KIBBLEWHITE Kathy • KIMBER Gord • KING Robin • KING Grant • KINNEAR Peter • KIRBY Chris • KIRSCH Marie-Anne • KLIMCZUK Mavis • KLIMCZUK Kris • KNOPP Don • KNOX Hal • KOLES Steve • KOPP Emily • KORCHINSKI Merl • KOWALSKI Alice • KOWALSKI Sherry • KOZOKOWSKY Greg • KRAYCHY Carol • KRYGER Ed • KUEHN Donna • KUHN Larry • KUMMER Lorrie • KUNTZ Ron • KUZMA Corinne • KWASNY Val • KWONG Jeanette • LAIN Denise • LAING Bruce • LAKHANI Anar • LALLANI Anisa • LANGLO Cynthia • LARRATT Al • LARSON Andrea • LAUBMAN Dan • LAWRENCE Stu • LAWRENCE Bonnie • LEE Susan • LEE Maxine • LEE Shu • LEE Connie • LEHMANN Detlef • LEITH Angelita • LEKTSOG Brian • LEONARD Earl • LESLIE Ed • LEUNG Norman • LEUSSINK Karen • LEWIS Harry • LI Louis • LIETZ Connie • LIFESO Clayton • LILLO Harry • LINDSAY Cleva • LINDSAY Todd • LINES Kathy • LITTAU Dorlean • LOCHHEAD Carol • LOCK Mike • LOGAN Karen • LONGLEY Russ • LONGWORTH Herb • LORD Nelson • LORENZO Murray • LOTA Satwant • LOUGH Jack • LOUIE Anna • LUCYK Brian • LUFT Sonia • LUFT Mary • LUONG Lee • MacDONALD Sandy • MACDONALD Ian • MacGILLIVRAY Joe • MacRAE Jackie • MAHADEO Ernest • MAHE Elaine • MAHERALI Yasmin • MAIN Andrea • MAKINSON Donna • MAKSYMETZ Rick • MAKWICH Val • MALONE Shawn • MANNING Marilynne • MARLER Simone • MARSH Rick • MARTINUZZI Larry • MATILLA Auring • MATTHEWS Gary • MAXWELL Larry • MAY Ed • MAY Vicki • MAYER Al • MAZUREK Larry • McCULLOUGH Dennis • McFARLANE Brian • McGUFFIN Shirley • McINTOSH Joseph • McKINLEY Cindy • McLEAN Greg • MCLEAN Kelly • McMORRIS Ken • McMULLIN Priscilla • MCNALLY Tom • McNEIL Marvin • MEIER Dan • MEIMA Pieter • MERCHANT William • MERRIAM Neil • MEYER Susan • MIKALSON Michele • MILES Connie • MILLER Jenny • MILLER Mark • MILNE Brandy • MILNE Andy • MILTIMORE Anita • MINGO Terri • MINK Frank • MOELLER Eric • MOLINA Carolina • MOLONEY John • MOLYNEUX Margaret • MOORE Pat • MOORE Andy • MORAN Anne • MORRIS Dave • MORRISON Russell • MOTIUK Neil • MULLER Sieg • MULLIN Judi • MUMBY Merv • MURRAY Val • NAHAL Harvey • NAINI Abbas • NASTASA Nick • NATYSHEN Rob • NAWATA Nancy • NEDJELSKI Laura • NEILSON Maggie • NELSON Joy • NEWTON John • NGUON Jennifer • NGUYEN Khoa • NICHOL John • NIEWINSKI Ed • NORRIS Nancy • NYCHKALO Hank • O'CONNOR Carolyn • OGG Tish • OGILVIE-DANIEL Arlene • OLD Nancy • OLIVE Alyn • OLLIVER Bruce • OLSEN Barbara • OLSON Al • OLSON Brian • OPINKO Darrell • OSCIENNY Pat • PAGE Jill • PALMER Laura • PALMER Rick • PANCHALINGAM Panch • PANE Diana • PANKO Charlotte • PARKER Robin • PARKYN Rick • PASLAWSKI Larry • PATERSON Bob • PATERSON Alana • PATON Joyce • PATTON Joan • PAULSON Ron • PAULSSEN Karen • PAYZANT Steve • PEAREN Kathy • PEDERSEN Gloria • PEET Dave • PENNY Bruce • PESTA Tom • PETERSON Wes • PETROSKEY Gerald • PEZZI Ilse • PFANNMULLER Rosanne • PFLUEGEL Joanne • PHILP LeMoine • PINNEY Mark • PINTO Mary Anne • PIPPARD Ken • PIPPARD Dan • PITT Jaime • PITTIS Frank • PITTMAN Mike • POKORSKI James • POND Andrew • PONTO Mark • POON Eliza • POROPAT Marta • POSEY Gillian • POTTER Olga • PRASAD Brahm • PRICE Morag • PRINCE Phil • PURCELL Brian • PURDY John • PURVIS Ross • QUANTZ Earl • RAHNAMA Farhood • RAJABALI Nizar • RAJAKARUNA Shirley • RAJAN Nasim • RAMDIN Nehru • RAMSAY Barbara • RANCIER Caprice • RASHID Al • RAULICK Sharon • RAWLYK Donna • REID Jim • REID Lorraine • REINE Ron • REINE Peggy • REITER Michelle • REMMER Bill • RICHARDS Connie • RICHARDSON Joan • RICHARDSON Shane • RICHARDSON Elaine • ROBERTS Don • ROBERTSON Cathy • ROSE Anna • ROSGEN Tony • ROSSO Steve • ROUSSON Randy • RUNIONS Tammy • RUZIK Dino • SABAJTIS Margaret • SADLER Keith • SAGAN Frank • SALISBURY Glenda • SAMCHOK Tsultrim • SAMSON Lorne • SAMUELSON Dave • SANDERS Doug • SARNECKI Dan • SAULNIER Paul • SAVAGE Bob • SAVARD Shirley • SCHAEFFER Dianne • SCHAFER Dale • SCHIEFNER Don • SCHIEMAN Kelly • SCHMIDT Barb • SCHMIDT Les • SCHMITTEN Kirsten • SCHNITZLER Bill • SCHOFIELD Charissa • SCHREIBER Henry • SCHROEDER Bob • SCHROTER Greg • SCHULDHAUS Ken • SCHULTZ Char • SCOTT Barry • SCOTT David • SCULLION Susan • SELKIRK Bob • SEMCHUCK Murray • SHARP Ken • SHARP Brenda • SHEANE Barb • SHEKA Tashi • SHEKA Yangchen • SHELLENBERG Tammy • SHEPARD Art • SHIMA Elvira • SHINN Barb • SHIRLEY Earle • SIEBEN Carmen • SIKORA Valerie • SILVER Ken • SKAPPAK Don • SKARSTOL Steve • SLADE Kathy • SLYMON Stew • SMITH Steve • SMITH Steve • SMITH Ernie • SMITH Heather • SMITH Pat • SNYDER Denise • SOMMERSTAD Donna • SORENSON Fred • SORON Laura • SPANGELO Jim • ST. LOUIS Myra • STAGG George • STANG Joanne • STARLING Bill • STENSON Joanne • STEPHENSON Derrick • STERLING Loretta • STERLING Paula • STEWART Barry • STONE Brad • STONE Ray • STONEHOUSE Derek • STOTZ Mary • STREM Jeff • STUART Karen • STUDER Dennis • STURM Shantel • SUMLAK Warren • SUMMERSGILL Carol • SUTHERLAND John • SVENNESEN Jill • SWAIN Bob • TA Tran • TABOR Donna • TANNER Pat • TARRAS-COLE Tracy • TAYLOR Shellie • TERADA Lorne • TETZLOFF Mary • THAKKAR Chandrika • THOMAS Graham • THURGOOD Colleen • TING Angela • TINKESS Bill • TONDU Shane • TOPACIO Evelyn • TOPYGAL Thinley • TORVI John • TOUCHETTE Leo • TOYNE Christine • TRAN Lisa • TROTTA Licia • TSE Phil • TSE Karen • TURNER-HULL Joslyn • ULCH Karen • VAIDYA Anna • van der WIEDE Nancy • VAN HORNE Judy • VANCE Cheryl • VANDENBELD Peggy • VANDENBELD Martin • VANDENBERG Sandra • vanEGMOND Dirk • VARGA Imre • VARMA Ajay • VENTER Ron • VERMEULEN June • VISRAM Amyn • VISRAM Nashila • VISSER Ben • VOGT Greg • VOGT Valerie • VRSKOVY Milan • WAGENER Ron • WAISMAN Dwayne • WALDEN Thorn • WALKER Alison • WALLER Gail • WARCHOLA Yvonne • WARREN Andy • WEBB Cathy • WEBSTER Dean • WEIK Donna • WEKEL Jim • WELESCHUK Ivan • WELLMANN Guenter • WETYK Rick • WHEELER Barry • WHITTAKER Laurie • WICKEL Pat • WICKENS Jeff • WICKSTROM Clay • WIEBE Brad • WIECHERT Agnes • WILCOX Laurie • WILEY Dave • WILKES Jerry • WILL Terry • WILLARD Bob • WILLIS Denise • WILSON Jim • WILSON Kathy • WILSON Sandee • WILSON Alister • WILSON Laurie • WILSON Greg • WILSON Shauna • WINGERT Heidi • WINTER Gord • WONG Tony • WONG Francisco • WOOD Alexandra • WORKMAN Lou • WOYNAROWICH Lorne • WRIGHT Richard • WRIGHT Derry • WYLIE Bill • YEH Peggy • YOUNGSTROM Dale • YU James • ZABORSKI Irene • ZERBE Lynette

ERCB's most valued resource—its people. This list features the names of all full-time and regular part-time employees as of 15 March 1992.

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CANADIANA
MAY - 5 1992

Oil

Gas

Oil Sands

Coal

Electricity

The colour bars above relate to the specific energy resources indicated. These same colours are used in charts throughout the publication.

Metric/Imperial Energy Equivalents
Energy 1 petajoule = energy equivalent of 164 000 barrels of crude oil
= energy equivalent of 1 billion cubic feet of natural gas
Oil 1 cubic metre = 6.3 barrels
Natural Gas 1 cubic metre = 35.3 cubic feet
Coal 1 tonne = 0.98 long ton (2240 pounds)
= 1.1 short ton

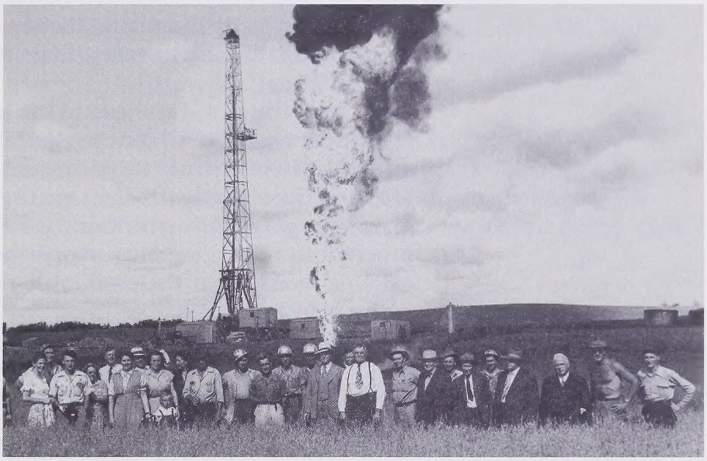
Cover photo

Chemical Technologist Joanne Pfluegel is an important part of the ERCB's commitment to quality service to industry, government, and the public. At the ERCB Chemical Laboratory, she tests sump fluids to ensure they can be disposed of safely.

Special Feature Article

The future is going to happen! ERCB hopes to help shape it, rather than watch as it goes by

There is much argument about what is causing it, but there is no doubt about the subject being debated: the world of energy is changing dramatically and rapidly, not only provincially, but worldwide. And with it, the world of the ERCB also is changing.



The world it is a changin'. Forty-four years ago, just about everyone in the community eagerly turned out to watch a new well blow in. The crowd above gathered in front of Continental Rig #9 in the Woodbend Field in 1948.

Today, all segments of society are concerned about the environment. At this recent hearing in east-central Alberta, the Board heard the concerns of farmers living near heavy oil development.

Consider some of the challenges facing the ERCB in this era of significant change. After 53 years of regulating an expanding energy industry, the ERCB now finds itself confronted with a fundamentally different set of realities, including

- declining Alberta reserves of conventional oil
- a relatively low market price for conventional oil, with limited prospects for improvement
- growing opportunities for producing lower-cost energy supplies in other parts of the world, accompanied by an outflow of talent and capital from Alberta
- economic and environmental factors making the development of the province's huge oil sands reserves more difficult
- large amounts of natural gas in the province, but much of it controversially and expensively sour
- weak North American gas prices and markets that threaten the viability of many small Alberta operators
- an aging energy infrastructure, with all of the implications inherent in that aging, including expensive replacement of existing facilities, or the even more expensive shut-down of the oldest facilities
- increasing land-use conflicts between energy developments and a growing population
- a public more determined than ever to have a say in how industrial development proceeds

ERCB opts for quality in all its services

Faced with these difficult issues, the ERCB recognized the need to adjust to these realities and work to shape its future.

Early in 1991, the Board initiated a program to review how ERCB "customers" perceived the need for a broad cross-section of its tasks. The long-term goal is the continuous improvement of ERCB services to all customers, both internal and external. This is complicated by a need to do the necessary work better with fewer resources.

In the past year, the Board and its staff have been engaged in an in-depth analysis of ERCB functions, and what its people and customers believe it should be doing in the future.

In support of this analysis, the ERCB has introduced a program with emphasis on the delivery of quality services. ERCB people now are being trained in this program, known internally as Quality Management and Service or QMAS.

An early effort in the ERCB's drive for quality was the involvement of Board members, managers, and all staff in the development of statements of Mission, Vision, and Values for the organization. These are statements of what the Board's purpose is and what its vision of the future holds for the people it serves, as well as the values shared by ERCB people.

Values must be shared

Confirming commonly-held values proved to be relatively easy. The ERCB has worked with Albertans for more than 50 years. The values underlying that work have been known, added to, and agreed upon for more than 5 decades. Thus, reaching consensus on the values held by ERCB people proved to be fairly straightforward.

Mission and vision must be clearly stated

Considerably more work was involved in developing a corporate vision statement. The first step was to state the ERCB's mission succinctly, that is, its reason for being. This was no easy task.

Setting the ERCB's vision of the future proved to be even more difficult. In a world changing as rapidly as the ERCB's, vision and change seem almost to be interchangeable words. Vision seems difficult to pin down long enough to set in type.

ERCB people at all levels of the organization struggled with the words, and the first draft of their work caused wide-ranging in-house discussion and debate.

Vision must have stretch

Adding to that level of difficulty is the most essential ingredient of vision—"stretch". A vision should not be a restatement of what is being done today. Rather, it should be a thoughtful description of where the organization is going—one that allows for that extra effort that represents "stretch", both for its mandate and for its people.

The work of developing a formalized vision has not yet been completed. QMAS teams are at work throughout the organization consolidating the thoughts of people at all levels of responsibility.

While most now agree with the thoughts contained in our draft vision statement, the ERCB will use it as a working document to guide its involvement with its customers.

Search for quality is under way

At the same time that various QMAS teams were wrestling with putting into words the ERCB's Mission, Vision, and Values, other teams were examining many aspects of what the organization currently is doing, looking for work being done that perhaps could be done more efficiently, or possibly work that does not need to be done at all. Many related discussions were held with customer groups, both inside and outside the organization.

To make this effort viable, staff first had to consolidate its thinking regarding customers. The ERCB always has prided itself in its provision of services to Albertans. Thus, it was not difficult to think of the public as being a "customer". More difficult has been the concept that work provided by one internal department to facilitate the work of another makes the second department a "customer" of the first. In other words, the receiving department is entitled to expect the same quality of product or service that it would expect from an outside vendor.

The ERCB's work to strengthen the quality of its management and services has only just begun. The effort already involves nearly half the organization's staff. What to many is unfamiliar jargon today will become a powerful motivator in the coming months. The Quality Management and Service program will become a way of life at the ERCB and, we believe, will allow ERCB people to shape their future rather than just sit by the roadside and watch the future go by.

Important Events of 1991

Slow economic growth world wide
Alberta's economy is very sensitive to events that affect energy supplies, demands, and prices. This was especially true on the international scene in 1991. Except for the Far East, major industrial economies experienced slowdowns in 1991. In the words of the Organization for Economic Cooperation and Development, "economic growth . . . slowed sharply in the second half of 1990 and virtually ceased in the first half of this year. This is the weakest performance since 1982".

Oil prices surge during Gulf War, then drop
At the outset of the Gulf War crude oil prices fluctuated dramatically. By the end of the first day of the war—16 January 1991—marker crude oil prices closed at about U.S. $30 per barrel, while off-exchange trading in spot crude oil approached $40 per barrel. This was double the price of oil just before Iraq invaded Kuwait the previous August. On 17 January 1991, oil prices experienced the sharpest 1-day drop in history, in response to continuing excess supplies and perhaps an expectation that the conflict would be short-lived.

At year-end, Kuwait's oil production had recovered to only one-third of the rate before Iraq invaded. Iraqi oil production was still subject to an international embargo. Resumption of oil production by these two countries at historic rates would mean adjustments to oil production elsewhere, or lower world oil prices.

Despite slow industrial growth, Dow expands petrochemical base
A ground-breaking ceremony was held in September for Dow Chemical Canada Inc.'s Hydrocarbon Project, a major expansion of Alberta's petrochemical industry. This $800-million project located near Fort Saskatchewan will significantly increase Alberta's ethylene and polyethylene production capacity. A unique environmental feature of this project is the creation of a wildlife green belt around the plant site. Construction will commence in 1992, with start-up planned for 1994.

Located east of Edmonton, Canada's first facility for producing MTBE, a non-lead gasoline enhancer, neared completion at the end of 1991.

One petrochemical facility was commissioned in 1991 in Alberta: DuPont Canada Inc.'s Sturgeon County hydrogen peroxide plant, which will supply a chlorine-free bleaching agent to the chemical and pulp industries.

In addition, at year-end, construction neared completion on Alberta Envirofuels Inc.'s MTBE plant in Strathcona County, east of Edmonton. MTBE is an additive used to enhance the octane rating of gasoline, replacing the use of tetraethyl lead which was phased out in 1990.

Construction also proceeded on Shell Canada Limited's $825-million Caroline Project, while work on the Husky Bi-Provincial Upgrader, in the Lloydminster area, neared the halfway point at year-end.

Clean Air Strategy recommends regulatory change
Following an intense public consultation process, the Clean Air Strategy for Alberta was presented to the provincial Ministers of Environment and Energy in November. From the ERCB's perspective, one of the main recommendations was that the Natural Resources Conservation Board and the ERCB adopt a "full-cost" approach in weighing the public interest in development projects. Such a system would involve both the social and environmental consequences of approving development applications.

ERCB releases major energy requirements report
In 1991, the ERCB updated its energy requirements forecast, last published in 1986. This forecast is an important planning tool for such things as meeting future electrical demand and planning long-term gas removals from Alberta.

Energy prices and economic activity are the key factors underlying Alberta's energy requirements. Production of conventional crude oil is projected to decline steadily. In 2005, the ERCB expects the province will be producing 40 per cent less conventional oil than it did in 1991. One implication of this is that Alberta will produce a mix of resources in future that, on average, will generate lower provincial royalties than today.

As demand for Alberta's natural gas increases, so will the production of greenhouse gases. The ERCB's 1991 energy requirements forecast included such emissions for the first time.

Greenhouse gases part of energy requirements forecast
For the first time, the ERCB's requirements report considered the issue of energy production and consumption as contributors to the Greenhouse Effect. On the basis of the forecast, the ERCB expects Alberta-wide emissions of carbon dioxide to rise by 37 per cent and oxides of nitrogen by 14 per cent in the next 15 years. This scenario is based on the projection that natural gas will experience fairly rapid demand growth by 2005 as North Americans switch to gas to meet tougher emission standards for a number of greenhouse gases and acid-forming pollutants.

Emissions of methane and volatile organic compounds are estimated to decline by 14 and 25 per cent respectively because of slow growth in motor fuel consumption and more stringent emission controls for the transportation sector.

Since the forecast could not anticipate policy initiatives that may reduce greenhouse-gas emissions, the report concludes that it is still too early to discern what such actions would mean in terms of primary and secondary energy requirements in Alberta.

Landmark court decision on orphan wells

In June 1991, Alberta's Court of Appeal decided that a receiver in control of an orphan well must properly clean up and abandon the site even if it requires the expenditure of funds that would normally go to secured creditors. Orphan wells have no owners, little or no value, and have not been properly abandoned.

Known as the Northern Badger case, the court's decision was precedent-setting. In the past, some receivers "walked away" from property that required spending money for environmental work in order to deliver maximum return to secured creditors. This recent decision says that the party administering an insolvent estate must take reasonable action to comply with applicable laws even if it costs money.

This principle is important for the enforcement of environmental laws, especially in situations in which clean-up costs associated with well abandonment could be significant.

Early in 1992, the case was heard by the Supreme Court of Canada which denied leave to appeal, thus allowing the Court of Appeal decision to stand.

Alberta's Energy Resources

This section reviews events of 1991 as they apply to each of the province's resource sectors; namely, oil, natural gas, oil sands, coal, electricity, pipelines, plus related initiatives in protecting the environment.

1. Alberta's Energy Resources

(petajoules)

Remaining Reserves at the End of 1991

Conventional Oil and Pentanes	22 900
[illegible]	[illegible]
Bitumen and Synthetic Crude Oil	182 250
Coal	650 000

1991 Marketable Production

Conventional Oil and Pentanes	2 228
[illegible]	[illegible]
Bitumen and Synthetic Crude Oil	776
Coal	726
Hydro	7

1991 Sales

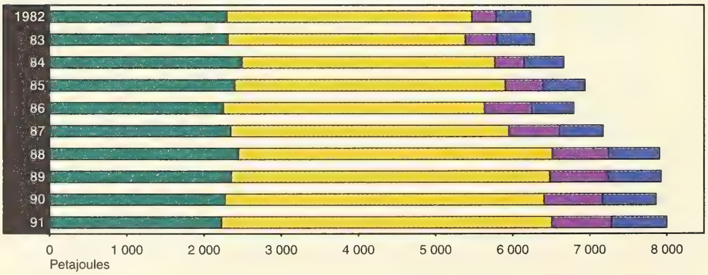
	To Alberta	To Other Provinces	Exports	**Total**
Crude Oil and Equivalent	688	1 014	1 328	3 030
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Coal	454	34	156	644
Hydro	7	0	0	7
Total	**1 821**	**2 055**	**3 147**	**7 023**
Per cent of Sales	26	29	45	100

2. Alberta Hydrocarbon Energy Resources

10-year production

Alberta's total raw energy resource production was up just 1.7% over 1990 levels.

- 🟩 Oil
- 🟨 Gas
- 🟪 Oil sands
- 🟦 Coal



Production pads such as this one in the Provost Field are typical of Alberta's growing heavy crude oil industry.

Production and Reserves—An Overview

Alberta's conventional **crude oil** production in 1991 was an estimated 51.7 million cubic metres, about 2.5 per cent lower than in 1990. Light crude oil productivity has steadily declined during the past 3 years because of declining performance from larger, mature oil pools. At the same time, drilling activity has not provided replacement capacity.

In contrast, 1991 production from conventional heavy crude oil was an estimated 10.5 million cubic metres, 3 per cent higher than the previous year. Daily production has been increasing from about 23 000 cubic metres per day in 1988 to almost 29 000 in 1991.

Alberta's remaining reserves of conventional crude oil at year-end totalled 470 million cubic metres. These reserves have been declining at an average rate of 7.5 per cent per year since 1988.

Since the mid-80s there has been a gradual change in focus from oil production to **natural gas** in Alberta's energy picture, although disappointing gas prices recently have reversed this trend. For example, production of marketable gas reached 88.3 billion cubic metres in 1991, up 4 per cent from 1990.

With a sharp decline in exploration drilling activity in 1991, additions to established gas reserves were the lowest in 4 years. This was the direct result of low gas prices and an oversupply of gas in Alberta.

Syncrude Canada Ltd. ended 1991 with a record production of 9.7 million cubic metres of **synthetic crude oil**, up half a million cubic metres from 1990. Suncor Inc. also recorded its most productive year ever, with 3.6 million cubic metres of synthetic crude oil. Crude bitumen production from in situ areas fell by 9 per cent to about 7.1 million cubic metres for 1991 because of lower prices for heavier crude oils which include bitumen.

Initial established reserves of crude bitumen are estimated at 747 million cubic metres for those deposits under active development. This comprises 644 million cubic metres of reserves from surface-mineable projects and 103 million from in situ schemes.

Alberta's 1991 production of raw **coal** increased by 5 per cent over 1990 levels, to an estimated 36.8 million tonnes. Raw coal is also known as run-of-mine coal, that is, unprocessed coal as loaded in the mine.

Deliveries of marketable coal increased by 6 per cent to 32.2 million tonnes for the same period. Marketable coal includes subbituminous raw coal and bituminous raw and clean coal (processed product with a uniformly low ash content) delivered to market.

Alberta's current coal reserves—those recoverable using surface and underground mining methods—remained unchanged at 32 billion tonnes.

Conventional Crude Oil

During 1991, the ERCB's Oil Department processed more than 2000 applications concerning pool depletion strategies, well spacing, and new oil pool declarations, as well as reserves submissions. Horizontal well drilling continued to be a growth area with 70 such wells approved in 1991, up from 34 the previous year.

The ERCB placed more than 1000 single well oil pools on "Good Production Practice" in 1991.

Good Production Practice reduces administration costs

To streamline the administration of oil production rate restrictions, the ERCB placed over 1000 single-well oil pools on "Good Production Practice" or GPP in 1991.

In an ongoing review of rate-controlled pools, the ERCB is finding that many pools are no longer capable of producing their maximum rate limitation. Further, the Board is prepared to remove rate restrictions where they are not needed for conservation and/or equity reasons, provided the pool is being produced using good engineering principles in accordance with ERCB-approved depletion plans.

The ERCB estimates it will place 300 multiwell pools on GPP early in 1992. This latest review will bring the number of producing oil pools now under GPP in Alberta to 75 per cent. That's up from about 15 per cent a decade ago.

Success story for energy and residential developers

When prospective buyers started looking at homes in the new Lewis Estates/Potter Greens subdivision west of Edmonton in the fall of 1991, they probably were not aware that they were part of a landmark effort in cooperation between residential developers and oil companies.

A brochure for home-buyers shows the way pumping oil wells have been strategically incorporated into the golf course. Lease sites, access roads, and flow lines have been carefully integrated into the subdivision plan. A site with two oil wells and a satellite facility is safely fenced and landscaped to blend in with the surrounding area.

In the early 1980s, oil and gas development and urban growth in the Acheson East Field west of Edmonton were on a collision course. To address this problem, the ERCB held a public inquiry in 1983. In its report, the ERCB suggested that careful planning and cooperation could result in a plan that would accommodate surface and subsurface development.

Although the housing development did not get off the ground for 8 years, these latest results seem promising. While the need for cooperation and consultation will continue as new neighbours move in, the success of this development also is critical to the well-being of the energy industry, home builders, and residents.

Natural Gas

The Mazeppa facility, east of Okotoks, processes gas from new reserves plus those previously handled at an older plant that now is shut down.

Plant consolidation benefits environment and industry

The ERCB has long required developers of new gas reserves to consider existing processing options before building new gas plants. These included tie-ins to nearby plants having spare capacity, or expanding existing facilities to meet the processing requirements of a wider area.

Although most consolidations were done for economic reasons, plant operators now acknowledge environmental benefits as well. In addition, where no new gas was available, some sour gas processors initiated integration opportunities for plants which had become too large because of declining production. Such consolidations have the potential to reduce sulphur emissions because sour gas formerly dedicated to less efficient plants is now processed at more modern ones.

In 1991, a task force assembled by Husky, Shell, Gulf, and Amoco began studying the feasibility of consolidating gas processing facilities in the south-central foothills of the province. Such a plan could reduce operating costs and sulphur emissions.

In 1991, the ERCB initiated a group to monitor coalbed methane development. (l-r) The ERCB's Tom Byrnes and Ken Schuldhaus review agenda items with Alberta Fish and Wildlife's Dave Christensen and Heidi Hardisty of the Canadian Parks and Wilderness Association.

Developing coalbed methane policy for Alberta

The ERCB and Alberta Energy jointly issued an informational letter[1] in August 1991 dealing with the following:

- the application of existing acts and regulations
- the formation of a coalbed methane task group
- the need for Alberta-specific coalbed methane information

To date, there has been very little evaluation of methane productivity of Alberta coal seams. The ERCB approved three small-scale experimental coalbed methane schemes in 1991, with only one well progressing to production testing during the year. Unless the need for "special" coalbed methane regulations is shown, the ERCB will apply existing acts and regulations to such projects.

Because of public interest in the subject, the ERCB also facilitated the formation of a public/industry/government group to monitor coalbed methane development in Alberta. This group consists of representatives from environmental and land-use groups, the gas industry, the coal industry, and various provincial regulatory organizations.

Underground gas storage gains popularity in Alberta

The ERCB is seeing increased interest in underground gas storage schemes in Alberta to cope with the cycles of high demand for gas in winter and low in summer. Producers find they can benefit from using depleted reservoirs for storage because some gas wells and most plants operate most efficiently with a constant throughput.

Year-round operation also enables ongoing production of co-products such as propane, butanes, pentanes, and sulphur, which have more stable year-round markets. As well, the strategic location of gas storage near major gas delivery points allows more gas to get to market, which requires less pipeline capacity from producing fields.

There are conservation and environmental benefits, too. Solution gas produced with oil can be reinjected rather than flared. In some instances, underground disposal of waste gases is a sensible alternative to uneconomic processing.

Shell demonstrates high H_2S production technology

In February 1991, Shell Canada started up its Bearberry Demonstration Project to test the feasibility of producing and processing "ultra-high" hydrogen sulphide gas.

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[1] IL 91-11, *Coalbed Methane Regulation*

This project is the first of its kind in the world. The Bearberry reserves contain such a high concentration of H_2S—90 per cent—that sulphur, not gas, is the only marketable product. Through its period of operation, the plant achieved output corresponding to about half of approved capacity. The Bearberry field could add significantly to Alberta's reserves of sulphur.

Although the Bearberry project was approved to operate for 5 years, Shell announced it would shut down and dismantle the facility in 1992. Although the project was a technical success, according to Shell, the prospect of weak sulphur prices and markets will not allow operations to continue. When sulphur markets improve, Shell expects to process the gas at its new Caroline plant.

Peggy Reine and Ken Hunt, members of the ERCB's Inactive Well Group, are working to reduce the number of such wells in Alberta.

Inactive wells a growing concern

Inactive wells are defined as having had no production or injection in a previous 12-month period. Of the nearly 146 000 wells drilled to date in Alberta, about 27 500 are listed on the ERCB's records as inactive. From 1985 to 1990 alone, the number of inactive wells increased by 34 per cent.

The ERCB is concerned that the proliferation of inactive wells could have adverse consequences for public and environmental safety as well as for the conservation of oil and gas resources within suspended zones. Of equal concern is the potential for many inactive wells to join the ERCB's growing list of orphan wells.

The ERCB issued two interim directives[2] to owners of inactive wells in 1990 and 1991. As operators comply with these new guidelines, the ERCB expects that the number of inactive wells will decline to manageable levels.

Oil Sands

OSLO Application Review Team winds down

In April 1991, after 3 years of work, the OSLO (Other Six Leases Operation) group decided not to proceed with a proposed $4 billion oil sands plant as planned.

During the project's preparatory phase, the ERCB facilitated the formation of the OSLO Application Review Team (ART) with representatives from OSLO, provincial and federal governments, Native groups, and local municipalities.

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[2] ID 90-4, *Suspension Guidelines for Inactive Wells*
ID 91-5, *Suspension Guidelines Compliance Schedule and Application Requirements for Inactive Wells*

The team's objective—and that of its eight subcommittees—was to provide a framework of cooperation and communication among participants to ensure their satisfaction with project design and management. The ERCB anticipated that the process would reduce the time and costs of formally reviewing the application and the hearing procedure.

With the project on hold, the ART team believed it was important to document its work to date, to identify issues still outstanding, and to recommend future directions. In November 1991, OSLO ART released its interim report[3]. It suggests there be an ongoing means to keep participants informed and thus in a position to move forward quickly should the project be reactivated.

The document also suggests that a number of key technical issues relating to bitumen extraction, tailings management, and energy efficiency warrant continued attention. The goal is to develop more environmentally acceptable and efficient technologies to benefit existing and future oil sands projects.

A prolonged drought led to the suspension of industrial water use from Cold Lake in October 1991.

Water, air and tailings top oil sands environmental agenda
Water use by in situ oil sands and heavy oil projects continued to be a major issue in 1991. At Cold Lake, a prolonged drought has reduced water levels to their lowest in 30 years. As a result, water withdrawal from the lake was suspended in October 1991. Cold Lake is the major water source for Esso Resources Canada's nearby commercial in situ project.

During 1991, Alberta Environment's Regional Air Quality Coordinating Committee (RAQCC) completed a full year of operation of its odour protocol program in the Fort McMurray/Fort McKay area. With representatives from industry, government, and local communities, RAQCC provides a forum for the reporting, analysis, research, and resolution of air quality issues in the Fort McMurray region.

Growing public and media awareness of RAQCC's odour protocol—to reduce or eliminate odours caused by oil sands processing—resulted in a 70 per cent success rate in tracking odour incidents to a specific industrial source in 1991.

While this program is still beginning, RAQCC believes that much has been accomplished through a cooperative effort. Participants look forward to greater progress in identifying remedial and long-term actions, and in eliminating potential sources of nuisance odours in the Fort McMurray/Fort McKay region.

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[3] *The OSLO Project, A Commercial Oil Sands Project, An Interim Report of the OSLO Application Review Team*

Suncor Inc. and Syncrude Canada Ltd. continued to research new ways of reclaiming fine tailings in 1991. Fine tailings make up that component of the sludge in tailings ponds which resists settling. Recent tests involved capping the fine tailings with fresh water. Early results seem to indicate that microbial activity naturally detoxifies the water above the tailings. If further testing confirms early results, Suncor and Syncrude may proceed with plans to create a biologically viable "live lake" in their mined-out pit areas.

Also during 1991, Union Carbide Canada Limited conducted a 9-month pilot test of its CANSOLV technology at the Suncor plant. Preliminary results were encouraging. If the technology were developed to a commercial scale, it could reduce sulphur dioxide emissions at oil sands and similar industrial facilities.

In situ developments proceed cautiously

The Cold Lake area of Alberta has some of the most advanced in situ oil sands developments in the province. During 1991, a key area of development was on the Primrose Weapons Range north of Cold Lake.

Amoco Canada Petroleum Company Ltd. and Suncor are proceeding with new initiatives at their respective commercial project sites. For Amoco, the development comes with the recent ERCB approval for seven horizontal wells to maximize bitumen recovery under a steam stimulation/gravity drainage process. For its part, Suncor applied to the ERCB in November 1991 to increase primary bitumen production as much as 2000 cubic metres per day.

Although site work has been completed for Phases 7 and 8 at the Esso Cold Lake Production Project, the company decided to defer start-up of these wells until 1992 because of depressed world oil prices.

In the Lindbergh area, Amoco's application for Phase 2 of the Elk Point commercial project continued through the application review and public consultation process. If approved, bitumen production would increase from 1280 to 2300 cubic metres per day from this project.

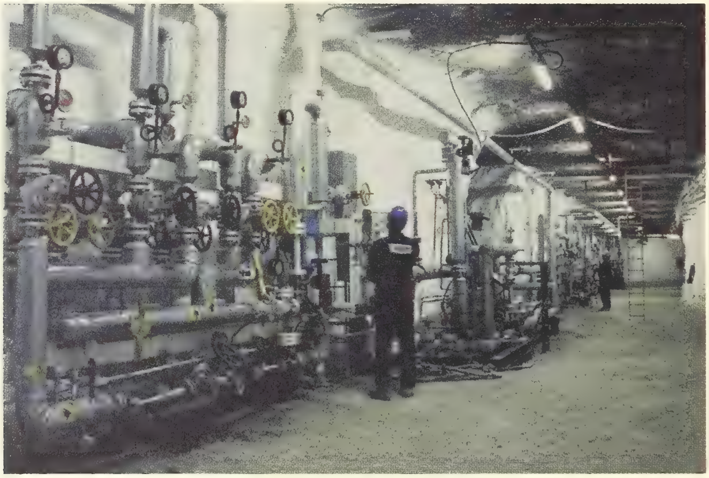
Oil sands experiments ongoing

Esso completed two experimental projects in 1991. One was an evaluation of the use of coal as a fuel source for steam generation at the Cold Lake facility. Although the 2-year test, a joint venture with TransAlta Utilities and Shell, provided useful information on coal as an alternative fuel, Esso decided not to proceed to a new phase of testing because of technical problems.

In another experiment, Esso tested borehole mining techniques for in situ reservoirs. Further evaluation will be required before proceeding.

The use of horizontal wells also is being tested in the Wabasca area by CS Resources at Pelican Lake. In 1991, an additional eight horizontal wells were drilled to about 1000 metres in length. These are some of the longest horizontal wellbores ever drilled in oil sands areas.

In June 1991, the Alberta Oil Sands Technology and Research Authority applied to expand experimental operations at the Underground Test Facility near Fort McMurray. This project entails six new horizontal wells to test the production capabilities of longer wellbores reaching up to 600 metres. If approved, bitumen production rates at the site are expected to increase from 400 to 500 cubic metres per day.

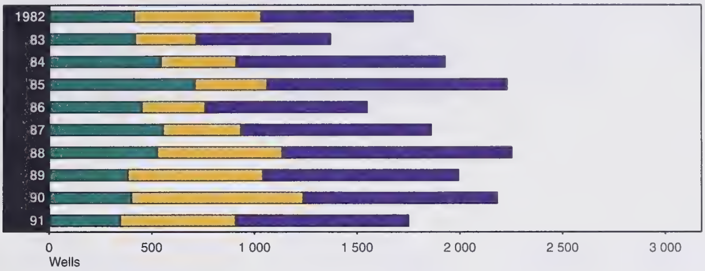


The Alberta Oil Sands Technology and Research Authority pioneered new technology at its Underground Test Facility near Fort McMurray. Parallel wells drilled from tunnels allow uniform heating of the oil sands reservoir above.

3. Oil and Gas Wells
Exploration

Low gas prices and uncertainty over future oil prices kept exploration drilling 20% below 1990 levels.

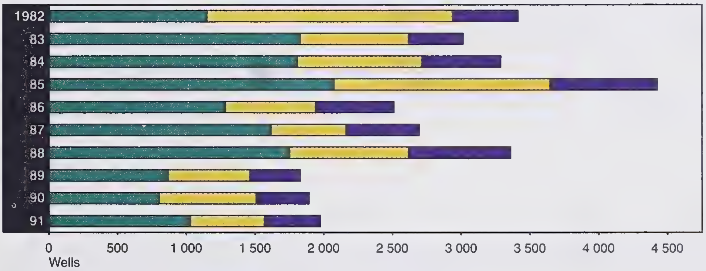
■ Oil
■ Gas
■ Abandoned and Other



4. Oil and Gas Wells
Development

Most of the modest increase in development drilling came from a 30% growth in the oil sector.

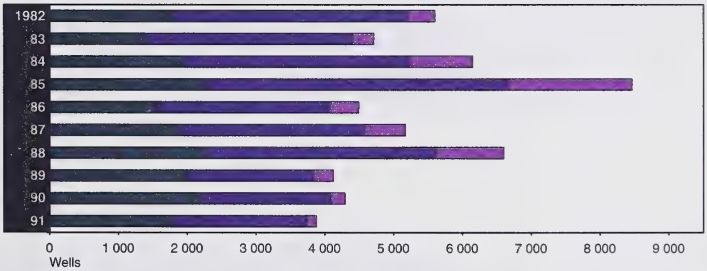
■ Oil
■ Gas
■ Abandoned and Other



5. Total Wells Drilled

Overall drilling activity was down 9% from 1990, reaching its lowest level in a decade.

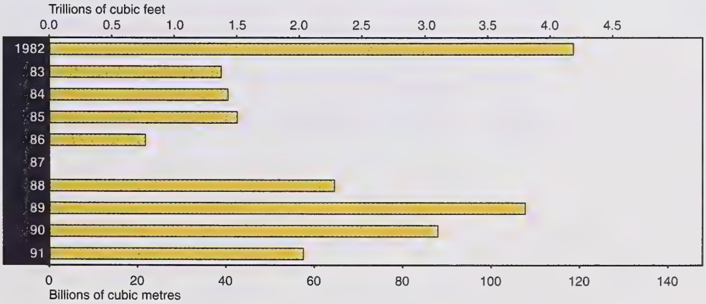
■ Exploration
■ Development
■ Oil Sands



6. Additions to Established Gas Reserves

Industry added 57.6 billion cubic metres of gas to reserves during 1991, compared to marketable gas production of 88.3 billion cubic metres.

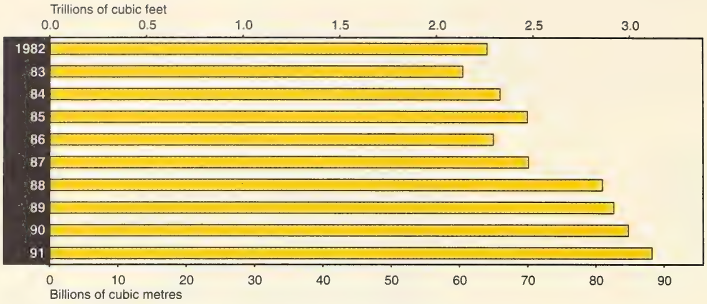
■ Gas



7. Gas Production

Production of marketable gas increased for the sixth year in a row despite low prices. Improved pipeline capacity, especially in the U.S. north-east, has opened new markets.

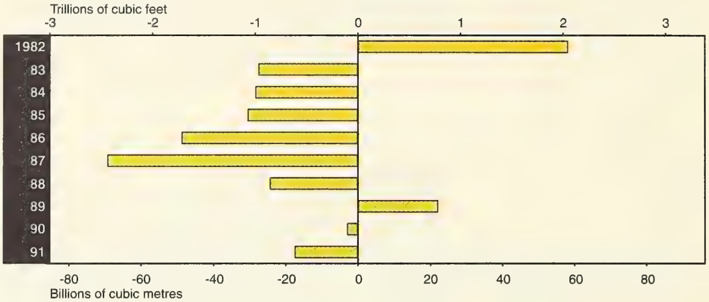
🟨 Gas



8. Changes in Remaining Established Gas Reserves

In 1991, gas reserves declined by 17 billion cubic metres. This reflects a one-time correction of 14 billion cubic metres for solvent flood injection schemes not accounted for previously.

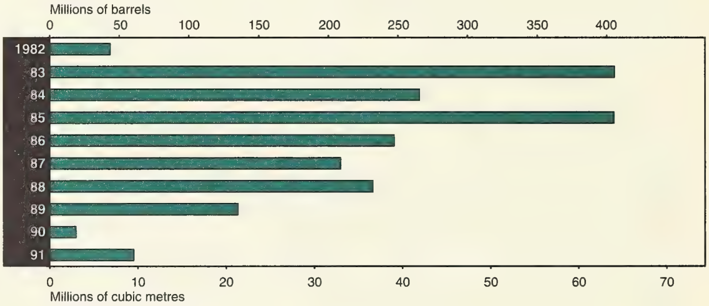
🟨 Gas



9. Additions to Established Oil Reserves

Additions to established conventional oil reserves were almost 10 million cubic metres in 1991.

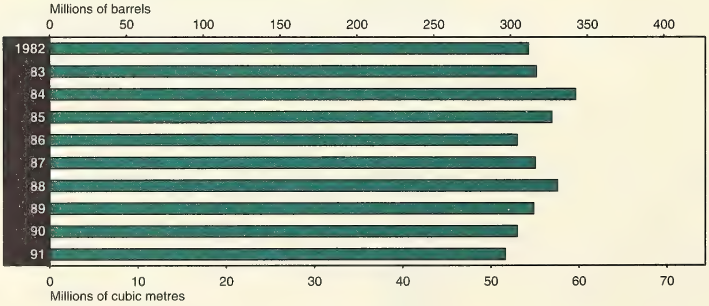
🟩 Oil



10. Conventional Oil Production

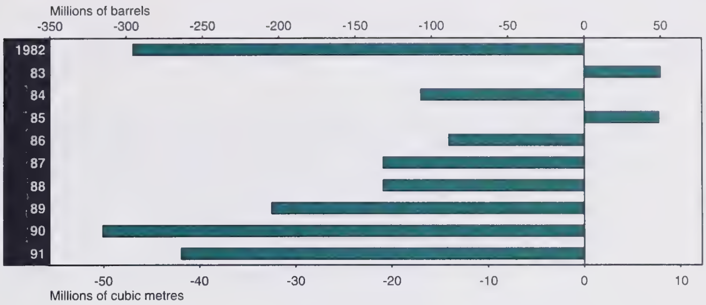
Oil production in 1991 was 2.5% lower than 1990, mainly because of low prices.

🟩 Oil



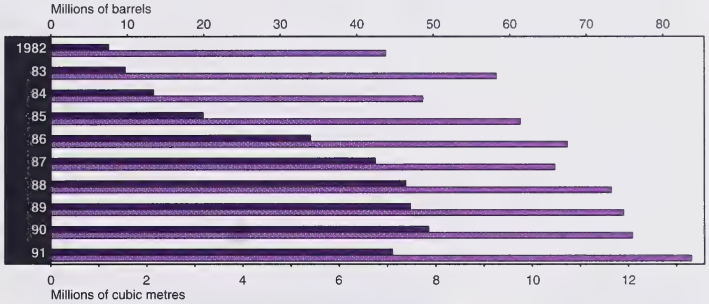
11. Changes in Remaining Established Oil Reserves

Producers continue to dip into reserves to meet demands for oil, resulting in a net decline of 42 million cubic metres in 1991.



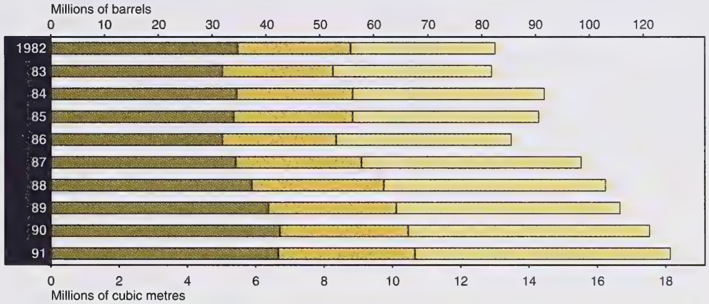
12. Bitumen and Synthetic Crude Oil Production

Synthetic crude oil production reached a record 13 million cubic metres in 1991. Crude bitumen production dropped by almost 9% because of low prices for heavier crude oil which includes bitumen.



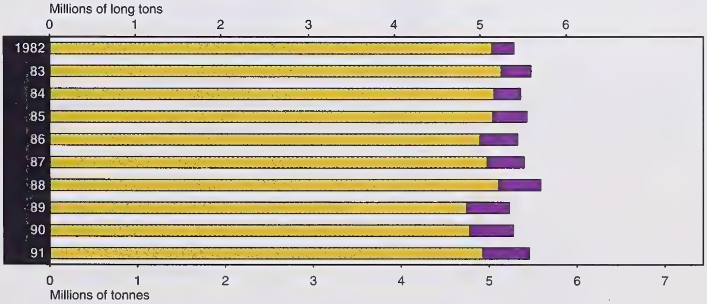
13. Natural Gas Liquids Production

NGL production increased by almost 3.5%, reflecting an overall increase in gas production for 1991.



14. Sulphur Production

Sulphur production increased by 3.5% to about 5.4 million tonnes because of growing natural gas production in 1991.



Coal

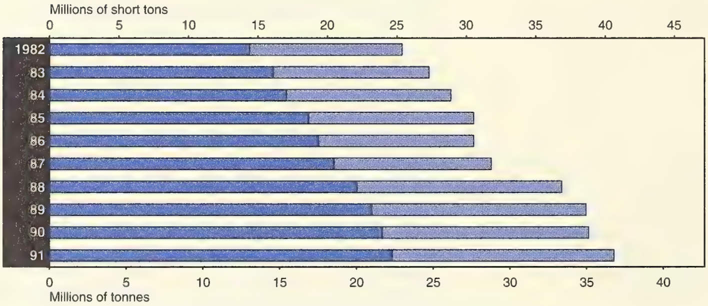
Coal exploration increased during 1991 for the fourth consecutive year. Companies drilled 823 exploration holes compared to 723 in 1990. Most exploration was concentrated around producing mines to replace depleted reserves. Some of this type of exploration was also related to the evaluation of leases for future prospects. Additionally, mine operators drilled about 534 development holes within existing mine permit areas.

On the development side, the ERCB granted Cardinal River Coals Ltd. two major mine permit boundary extensions to its mine near Hinton. This will ensure continued coal production at current rates. A small extension was also granted to allow for an underground mine at Smoky River Coal Ltd.'s operations at Grande Cache.

15. Raw Coal Production

1991 raw coal production was up almost 5% over 1990, in response to improved demand from offshore buyers and from Alberta's thermal electric plants.

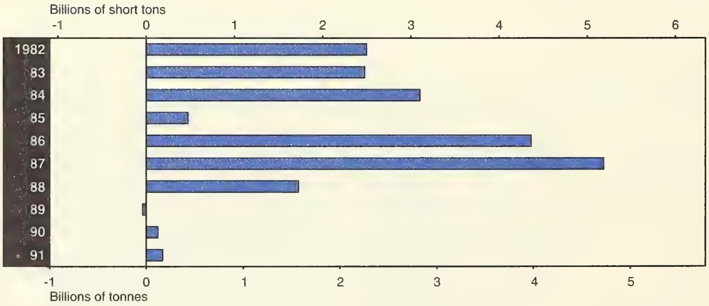
▨ Subbituminous
▨ Bituminous



16. Changes to Remaining Established Coal Reserves

Most exploration is concentrated around producing mines to replace depleted reserves. Alberta's reserves increased 200 million tonnes in 1991.

▨ Coal



Typical of Alberta's new small power projects is the Belly River Hydroelectric Plant in southwestern Alberta.

Electricity

Non-utility generators were the source of most activity in the area of electricity generation in 1991. A number of projects that have been granted allocation under the government's Small Power Program are in various stages of progress. These include wind plants, small hydro power plants, and wood waste- and peat-fuelled thermal plants.

The first electric energy generated under the Small Power Program came from wind plants in 1990. In the early summer of 1991, however, power from the Belly River Hydroelectric Plant which is located at an irrigation dam was delivered to the provincial electric system.

Active future for small power production

In addition to plants that qualified under the Small Power Program, the ERCB has for consideration several proposals by non-utility generators that are outside the scope of the program. These include a gas turbine plant at Stettler and a small plant to be fuelled by natural gas now being flared at oilfield batteries.

Late in 1991, the ERCB approved plans to complete the second unit at the Genesee Power Plant by 1994.

Thermal power development slows

After an August 1991 hearing, the ERCB issued an interim decision in early December to allow the second unit at Edmonton Power's Genesee Power Plant to proceed to completion by October 1994. Originally approved in 1980, the two-unit coal-fired power plant, each unit with a capacity of 406 megawatts, was delayed several times because actual load growth in the 1980s was lower than forecast when the plant was approved. The first unit was completed in 1989.

Annual electric load growth of 10 to 12 per cent in the northwest part of the province has led Alberta Power Limited to file an application for approval to construct a 40-megawatt gas turbine unit at Rainbow Lake. The ERCB is now reviewing this application.

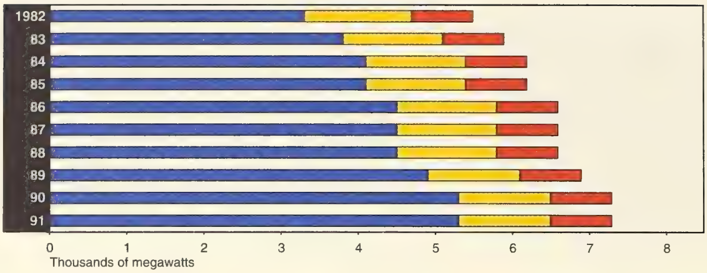
Modest transmission growth in 1991

In 1991, Alberta Power Limited completed a 144-kV line from Rainbow Lake to the British Columbia border to serve the Fort Nelson area. The City of Lethbridge completed its 138-kV supply system around that city, while TransAlta Utilities is installing various 138-kV facilities in the Caroline area, largely to supply Shell Canada's gas development project. Following public hearings, TransAlta also received approval to construct a 240-kV line from its Sundance Power Plant to Entwistle and a 138-kV line from Bickerdike to Hinton.

17. Generating Capacity for Electricity

Although schemes under the Small Power Program do not have an effect on total generating capacity, their numbers are increasing.

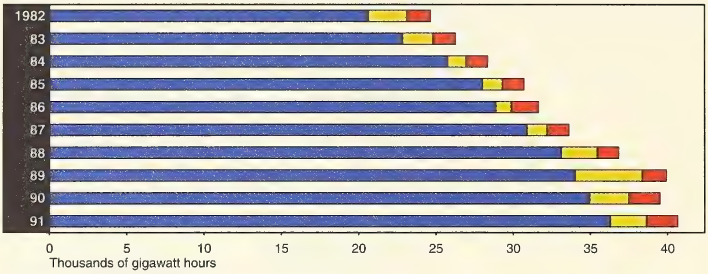
🟦 Coal
🟨 Gas
🟥 Hydro



18. Electricity Generated

Burning coal generates 90% of Alberta's electricity, while gas and hydro account for 6% and 5% respectively.

🟦 Coal
🟨 Gas
🟥 Hydro



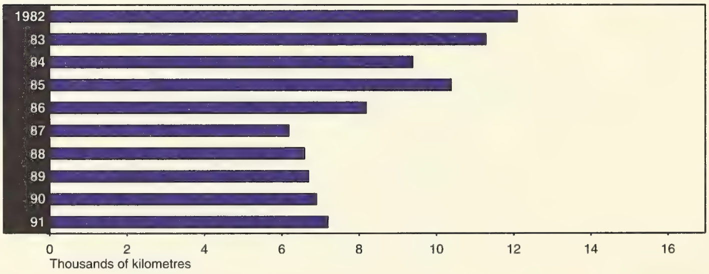
Pipelines

Levels of pipeline construction have remained steady for the past 5 years (see Figure 19), largely the result of NOVA Corporation of Alberta's sustained expansion of its provincial gas-gathering and transmission system. Indeed, more than two-thirds of the 7200 kilometres of total pipeline installed in Alberta in 1991 were related to natural gas activity.

19. Pipelines Installed

Alberta's total pipeline network stands at 215 400 km. The majority of the 7200 km of new pipelines installed in 1991 were small diameter flow lines.

■ Pipelines



Pipeline Department's Val Makwich (l) and Shu Lee (r) are part of the ERCB team reviewing NOVA operations.

Problems trigger review of NOVA's pipeline system

In June 1991, Alberta's Minister of Energy asked the ERCB to review NOVA's operations to investigate problems cited by shippers and producers. They were concerned with NOVA's management of its system and with the cost of transporting natural gas, especially during times of low prices.

The Board invited interested parties to work through a five-step process to include written submissions, interviews, compilation of results, responses from all parties and, finally, Board recommendations to the Minister. The first three steps are now complete. In connection with 52 submissions, the Board interviewed 22 parties to clarify issues.

ERCB gathers information on moving gas to California

The export of Alberta gas to the California market has become a contentious issue because of two pipeline proposals, one by Pacific Gas Transmission Company and the other by the Altamont Gas Transmission Company.

The Alberta Government was concerned that the California market might not be able to support more than one of these pipelines. It believes there are gaps in the information available in the public domain which may hinder general decision-making.

The Alberta Government asked the ERCB to gather information on both proposals. In November, the ERCB set up a schedule and procedure for submissions by interested parties. The ERCB will summarize the information, without making recommendations, in a public report to be presented to the Government by mid-1992.

Changes made to Pipeline Regulations

The ERCB recently made some significant changes to its Pipeline Regulations:

- to address the proliferation of all types of industrial facilities, a company must now inventory nearby energy facilities before it can receive a permit to construct a pipeline
- Canadian Standards Association pressure testing requirements are now part of ERCB regulations, except for pipelines carrying gas with a hydrogen sulphide (H_2S) concentration of 10 mol/kmol (1 per cent by volume) or higher, for which the ERCB has even more rigorous pressure testing procedures
- in addressing the rising number of corrosion-related pipeline failures, the ERCB tightened requirements for inspections and tests to determine the effectiveness of corrosion mitigation procedures

- permit requirements for tank farms were tightened to ensure adequate information is submitted
- a pipeline right of way survey is now required before construction, in order to improve the quality and accuracy of map information
- the ERCB now accepts approved equivalents to traditional Board-produced pipeline maps, because of improvements in the electronic transfer of mapping data
- the ERCB now accepts alternatives to hand exposure of pipelines during winter excavation

(l-r) ERCB's Bert Johnson, Andrea Larson, and Alan Cassley coordinated a major study of pipeline performance in Alberta. Here they examine a piece of corroded pipeline.

Study shows pipeline failure rate unchanged

During 1991, the ERCB completed an analysis of the causes and magnitude of pipeline failures in the 1980-1990 period.[4] Failures are divided into leaks and ruptures. A pipeline leak is a very small opening which does not immediately hamper the operation of the pipeline. A rupture is the tearing or fracturing of the pipeline causing immediate impairment of the pipeline's operation.

Alberta statistics show there are 4.5 times as many leaks as ruptures. The main cause of leaks is corrosion; the main cause of ruptures is excavation activity, largely by third parties. Sour gas and high vapour pressure product pipelines have the lowest number of failures. The majority of liquid spills from pipelines are less than 5 cubic metres in volume. Of the more than 200 000 kilometres of pipeline in Alberta, more than 70 per cent is pipe of less than 150 mm in diameter, while 60 per cent transport natural gas.

There was an average of 600 failures per year, with the majority of these occurring on water or multiphase lines. These latter lines transport a mixture of oil, water, and gas.

The report shows that internal corrosion failures have been increasing steadily during the past decade. This has led the ERCB to tighten its regulations on corrosion monitoring. However, this growth in failures should also be considered in light of the total length of pipelines. Viewed in this way, the failure rate per unit length has remained relatively constant during the past 10 years.

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[4] *Pipeline Performance in Alberta,* Report 91-G, released in February 1992.

Energy Resources and the Environment

Central to the mandate of the ERCB is the safe and environmentally sound development of Alberta's energy resources and facilities. This section examines a number of important developments in 1991 that will help maintain and protect a healthy and safe environment for Albertans.

Waste management tops list of environmental challenges

The management, treatment, and disposal of oilfield wastes produced by the upstream petroleum industry falls within the ERCB's jurisdiction. These are complex issues. At the end of 1991, after several years of cooperative effort by industry, government, and the ERCB, there was considerable progress in the following areas:

- regulation of oilfield waste processing and disposal facilities
- disposal of drilling wastes
- decommissioning of flare pits and ecology ponds
- road disposal of oily wastes
- remediation of contaminated sites
- decommissioning and reclamation of energy facilities

Research is crucial in developing ways to protect people and the environment. Senior Chemical Technologist Irene Zaborski uses a liquid chromatograph to test water samples from well sites.

Research helps solve waste problems

The ERCB has a well-defined method for developing new waste management guidelines or for reviewing existing ones. The first step pinpoints current or potential problems. The next stage involves a thorough information exchange to identify gaps in information or technology. Often, research projects are then designed to supply missing information or to confirm if existing practices are still appropriate. The goal is to create a database of scientific information from which future guidelines can be drawn.

The Oily Waste Task Force, which started work in 1989, is a case in point. Oilfield wastes have been used for years on Alberta roads for dust suppression, or as a surfacing material. In response to concerns that this practice could be harmful to vegetation and water, the task force conducted research to characterize oily wastes and to establish criteria for applying such materials safely. Tighter guidelines are expected early in 1992.

New emergency requirements for HVP pipelines

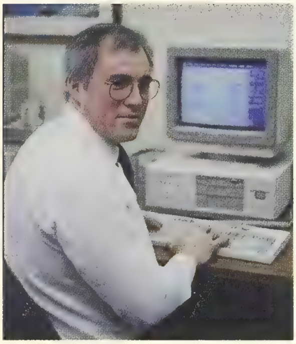
Under revised provisions to the ERCB's Pipeline Regulations, operators of high vapour pressure (HVP) pipelines are required to prepare and maintain emergency manuals.

HVP liquids include ethylene, ethane, propane, and butanes. They are colourless, almost odourless and, with the exception of ethylene, are heavier than air. When these liquids are released to atmosphere and become gaseous, their volume can expand up to 300 times. The major threat from HVP products is their ease of combustion, which often leads to an extremely explosive situation.

An industry/government task force was set up in 1991 to review existing standards and to develop recommendations for the HVP emergency response planning process. This task force will explore topics such as planning zone definition, emergency levels, community and municipal involvement, media communication, and training and exercise requirements. A draft of the findings will be available for further public and government review in 1992.

During a sour gas emergency: stay indoors or evacuate?

Blowouts and major pipeline leaks are rare in Alberta. When an incident does occur, however, careful emergency planning reduces the potential for serious consequences to public health and safety.



Ian Dowsett was part of the ERCB team that evaluated computer modelling research that suggests that staying indoors during a toxic gas release is a viable alternative to evacuation.

Traditionally, when people were threatened by a toxic gas release such as H_2S, it was accepted practice to evacuate them from the area. However, some authorities had suggested that staying indoors might be a better alternative. Until this past year, there was insufficient scientific or technical information to resolve this question.

In 1986, an industry/government committee started investigating this issue. Using two computer models, the committee compared five cases in which people could be exposed to an H_2S release. The study[5] found that in all cases people located near such a release would have been safer staying indoors. The research concluded that taking shelter is a viable alternative to evacuation during releases of H_2S or other toxic substances.

---

[5] *A Technical Study of Shelter Versus Evacuation When Faced With a Release of Hydrogen Sulphide*

The ERCB acts as an important resource for more than 40 public, municipal, provincial, and company representatives taking part in CanadianOxy's consultation process for proposed sour gas developments east of Calgary.

Northeast Calgary working for win/win situation

In July 1991, the ERCB facilitated a major public consultation process for proposed sour gas developments on the north-eastern boundary of Calgary. Known as the Northeast Calgary Application Consultation Committee (NCACC), the group consists of more than 40 public, civic, municipal, provincial, and company representatives.

The group's objectives are to increase public understanding of sour gas safety and impacts, and to recommend specific modifications to make Canadian Occidental Petroleum Ltd.'s proposed development more acceptable. While NCACC was set up for a specific sour gas project, it also represents a significant opportunity for the public to improve the quality of other energy-related developments in the province.

As a result of this less formal and perhaps more effective way of gaining valuable feedback, the ERCB, government, and industry will be able to improve safety requirements in meaningful ways.

Local residents become focus of ERCB field work

Responding to energy-related public complaints has been a priority for the ERCB's field inspectors for many years. Since 1987, field staff have handled an average of 810 such calls each year.

To uncover potential concerns and to resolve them before they become major issues, field staff began a program in 1991 to explain the ERCB's role to local government officials, special interest groups, and the media. In addition, ERCB inspectors arranged informal visits with residents living near energy facilities. No specific complaints triggered these latter contacts. By year-end, field staff had completed almost 100 presentations and 700 visits.

Feedback was very positive from this effort. Field staff have already noted improved understanding of the ERCB's regulatory role among municipal and county councillors, and a willingness to refer constituents with energy-related problems to the local ERCB office. For residents living near energy facilities, face-to-face visits will continue, with the goal of reducing the number of problems that develop into serious issues.

Sales and Distribution

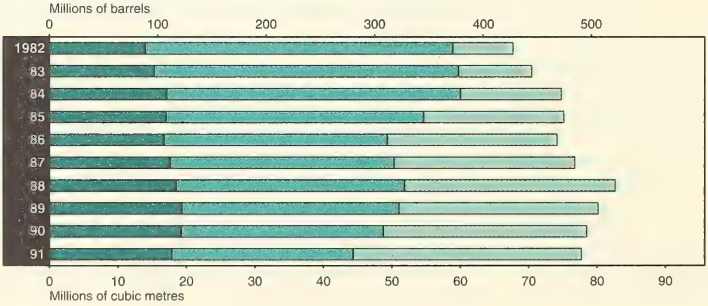
Demand for Alberta's energy resources remained strong during 1991. Sales of fossil fuels were led by strong growth in natural gas markets.

Although natural gas production increased in 1991, sulphur sales remained almost the same as in 1990. These levels are down by as much as 2 billion tonnes from record sulphur sales set in the early to mid-80s, as indicated in Figure 24. Sales of electricity have increased 70 per cent since 1982.

Oil

Total sales volumes of crude oil and equivalent fell by less than one per cent in 1991. However, the general downward trend in oil production in recent years reflects the continuing decline in the province's production of conventional light crude oil. This decline has been largely offset by increased production of conventional heavy and synthetic crude oil.

Sales to eastern Canadian markets in 1991 declined as Ontario and Quebec increased the relative share of their purchases from U.S. and offshore oil suppliers. Sales to U.S. Midwest refineries—primarily in the Chicago area—increased by about 10 000 cubic metres per day in 1991, almost offsetting the 11 000 cubic metres per day decline to eastern Canadian markets. Western offshore exports of crude oil—especially heavy crude oils—doubled in 1991 to 4000 cubic metres per day, mainly because of problems on the Interprovincial Pipe Line to eastern markets.



20. Markets for Oil and Equivalent

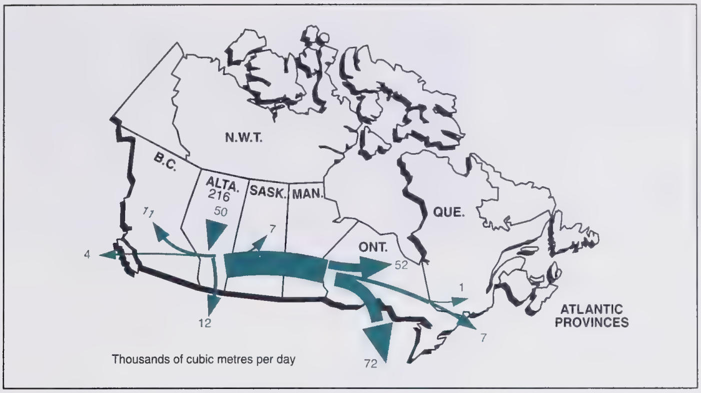
In each of the past 4 years, producers have delivered less oil to eastern Canadian markets, while U.S. sales have grown by 6% per year.

- ■ Alberta
- ■ Other Canada
- □ U.S.A.

21. Markets for Oil

Oil deliveries to the U.S. increased by about 12% in 1991, to about 91 000 cubic metres per day.

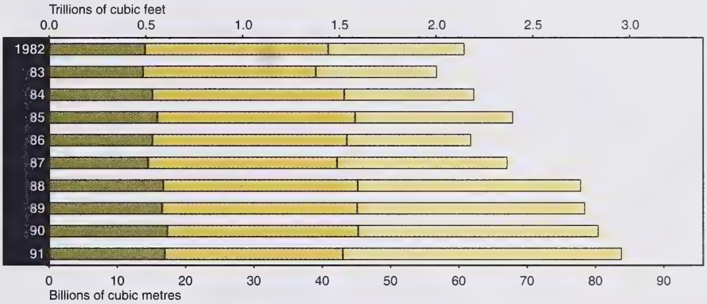
Legend
Production
Deliveries



22. Markets for Gas

While sales of natural gas within Alberta and other Canadian markets fell, U.S. customers took an additional 16% in 1991.

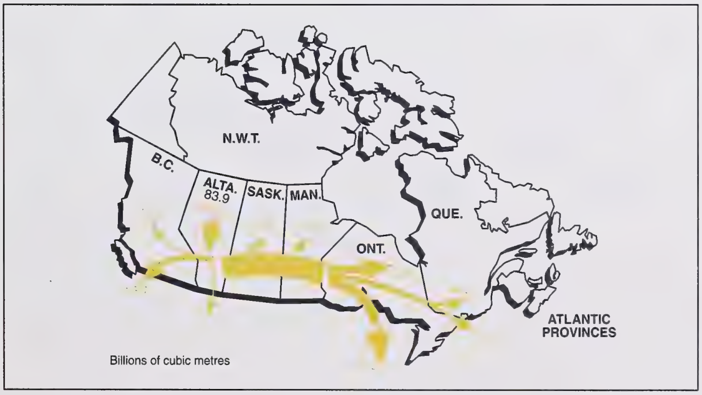
▨ Alberta
▨ Other Canada
☐ U.S.A.



23. Markets for Gas

Sales to U.S. markets accounted for almost half of all Alberta gas sales in 1991. The U.S. Midwest / West Coast were the primary destinations.

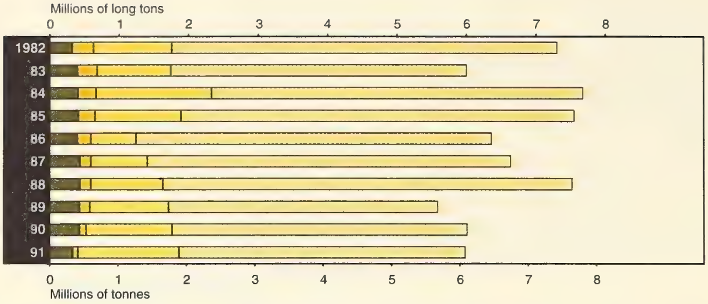
Legend
Production
Deliveries



24. Markets for Sulphur

Overall sulphur sales were unchanged in 1991 despite a 17% growth in U.S. sales.

■ Alberta
▨ Other Canada
☐ U.S.A.
☐ Offshore



Natural Gas

Marketable gas production and sales showed growth of about 4 per cent in 1991. While eastern Canadian markets consumed less Alberta natural gas than in 1990, total U.S. gas sales climbed almost 16 per cent in 1991. This demand increased because of improved pipeline access to northeastern American markets.

Sulphur

Sulphur sales during 1991 were virtually unchanged from 1990. Domestic sales fell 26 per cent to 425 000 tonnes. Offshore sales were down 3 per cent to 4.3 million tonnes.

Since 1989, Alberta producers have been unable to regain the virtual monopoly they once enjoyed in North Africa. Sales to the U.S. increased almost 17 per cent in 1991, to 1.5 million tonnes. Canada is still a major exporter of sulphur, accounting for about 35 per cent of world trade in this commodity.

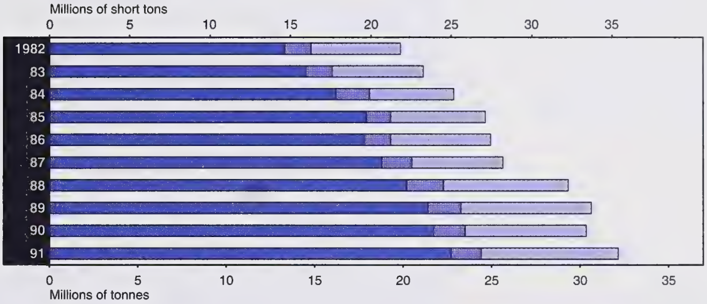
Coal

The demands of both domestic and export markets for coal remained fairly strong in 1991. Total coal sales increased by 6 per cent to 32.2 million tonnes. Deliveries to Alberta's thermal power plants were up 5 per cent during the year. Total offshore sales rose 13 per cent, with most of the increase attributable to strong market growth in Japan and Korea. Japan alone increased imports of Alberta coal by 17 per cent to 6 million tonnes.

25. Markets for Coal

Japan and Korea accounted for most of the 13% increase in offshore coal deliveries for 1991.

- ▨ Alberta
- ▨ Other Canada
- ▨ Offshore



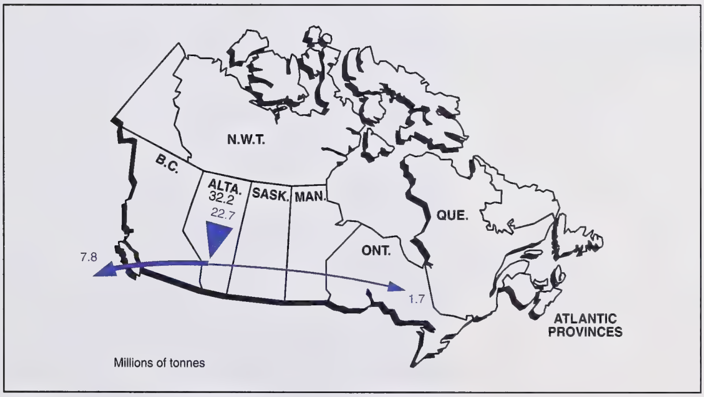
26. Markets for Coal in 1991

Japan's consumption of Alberta coal rose from 5 to 6 million tonnes in 1991. Thermal plants continued to be the largest user of coal in Alberta.

Legend

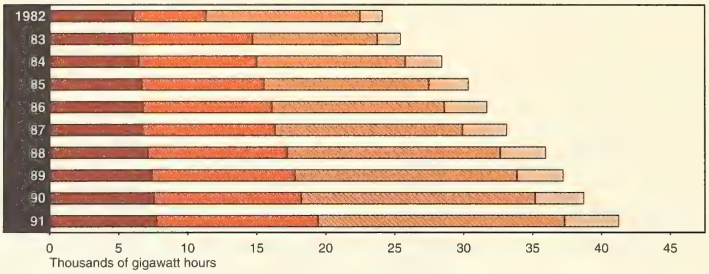
Production

Deliveries



Electricity

Electricity sales within Alberta increased slightly more than 6 per cent in 1991, compared to 1990 levels. The industrial and commercial sectors of the province's economic base showed the largest increases in demand, with 5.4 per cent and 9.2 per cent growth, respectively.



27. Electric Energy Markets

Overall demand growth accounted for the 6% increase in electricity sales in 1991.

- 🟥 Residential and Farms
- 🟥 Commercial
- 🟧 Industrial / Transportation
- ☐ Industrial On-site Generation

Alberta's coal-fired generating plants provide 90 per cent of the province's requirements for electricity.

Revenues, Investment, Employment

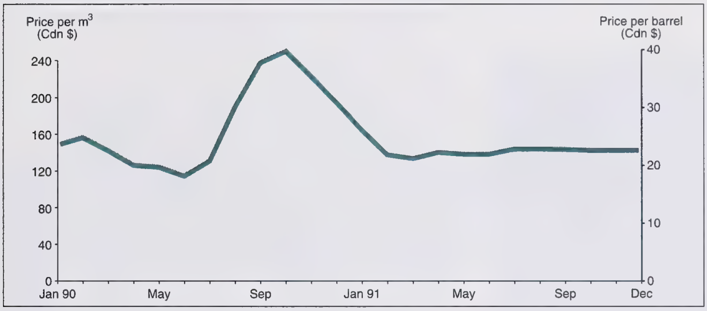
Energy continues to be a significant factor in the overall health of the province's economy. For example, total revenues generated by the energy industry include direct operating expenditures such as wages, royalties, and taxes. In 1991, the energy industry paid $2.8 billion in royalties and other fees, about 25 per cent of provincial government revenue. In addition, companies also pay income taxes, and property and business taxes to municipal and provincial governments.

Sales Revenues

Total sales of Alberta's energy resources and sulphur amounted to $16.1 billion in 1991, 15 per cent lower than in 1990, but about the same as in 1989. The reason is related to the Gulf War. Following the invasion of Kuwait in August 1990, oil prices peaked in October. Alberta's total energy revenues for 1990 reflected this oil price spike. 1991 revenues reflected the results of oil prices returning to pre-war levels.

28. Alberta Weighted Average Field Price Light Oil

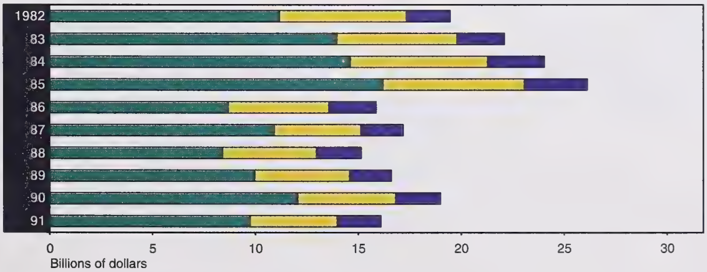
On 17 January 1991, the day after the Gulf War started, oil prices had the sharpest one day drop in history, perhaps reflecting the expectation that the conflict would be short-lived.



29. Gross Revenues
All Hydrocarbons

Total sales value of Alberta's energy resources was $16 billion, about 15% lower than in 1990. Lower oil prices following the Gulf War were the main reason.

🟩 Oil
🟨 Gas
🟦 Other



In 1991, the average wellhead price for natural gas dipped to $1.31 per gigajoule, 10 per cent less than the previous year's average. A North American economic slow-down, plentiful supplies from U.S. sources, a shift from long-term gas sales to those of a shorter duration, and a stronger Canadian dollar, all contributed to lower gas prices.

Competition among gas producers to supply local users, resulted in sharply lower prices within Alberta. Commissioning of the Iroquois Pipeline system late in the year should afford some relief in 1992 by allowing more Alberta gas to reach markets in the north-eastern U.S. This pipeline is not slated to reach full capacity until late 1992.

Sulphur prices fell to the lowest level since the 1970s. A variety of factors contributed to this: low natural gas prices intensified producers' needs for cash flow; both Canadian and Mexican sulphur producers faced U.S. price retaliation as they penetrated southern U.S. markets; India and the Soviet Union, as traditional importers of sulphur, had less hard currency available; and global recession and high sulphur inventories in North Africa also reduced demand.

Investing in Alberta's energy industry often includes the development of home-grown technology. This giant "iron" melts the face of the sulphur block, largely eliminating sulphur dust.

Investment

Alberta's energy industry increased overall capital investment in 1991 by 5 per cent, to $5.6 billion. This rise in investment reflects several major projects such as Shell Canada's Caroline Gas Development. Indeed, capital expenditures in the energy sector accounted for about 40 per cent of total capital investment in the province in 1991.

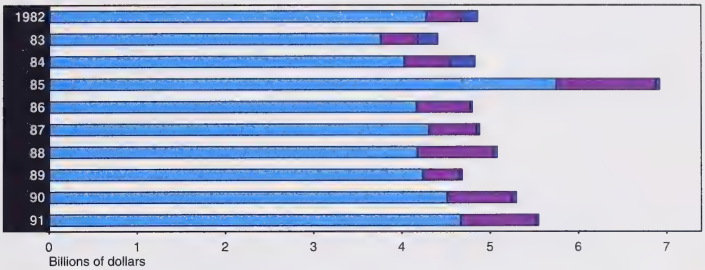
The energy sector is one of the most capital-intensive in the economy because the construction of coal mines, power plants, or large commercial gas processing facilities requires major investments. Such expenditures make a considerable contribution to the province's total economic output.

Retained earnings from profits are generally the source of capital investment, although equity issues and debt financing are alternative sources. Because lower prices and increasing operating costs are reducing oil and gas industry profitability in Alberta, continued industry downsizing is expected, especially if low world oil prices continue. As a result, decreased capital investment in the energy sector likely will be evident in the next few years.

30. Energy Investment in Alberta

Conventional oil and gas investment, up 3.4% in 1991, accounted for $4.7 billion of a total energy investment of $5.6 billion.

- 🟦 Gas and Conventional Oil
- 🟪 Oil Sands
- 🟦 Coal



Employment

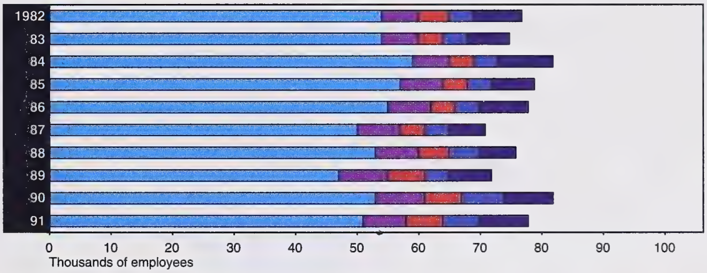
Direct employment in Alberta's energy sector decreased in 1991 to about 78 000 people (see Figure 31). Most of Alberta's larger energy companies reduced staff in 1991, and attempted to sell producing properties as part of an ongoing rationalization process.

The largest employment decreases occurred in the oil and gas sector, while employment levels in electrical utilities, coal, and oil sands remained fairly stable.

31. Employment in Alberta's Energy Industry

Employment in Alberta's oil and gas sector declined by about 4% in 1991.

- 🟦 Oil and Gas
- 🟪 Oil Sands
- 🟥 Electricity
- 🟦 Coal
- ■ Petrochemicals



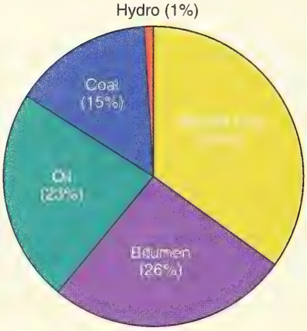
Energy end-use in Alberta

Except for coal, Alberta exports most of its energy resource production to other provinces, to the U.S., and to offshore markets. Of the portion that stays in Alberta, much is refined or processed for eventual sale beyond our borders. For example, Alberta's oil refineries—an internal market for crude oil—ship more than one-third of their output to neighbouring provinces and states, in the form of gasoline, diesel and aviation fuel, and asphalt.

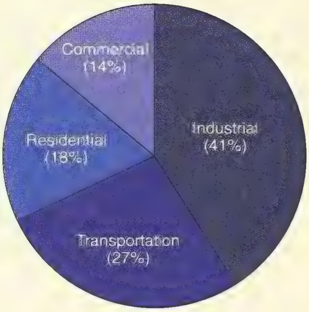
Natural gas is the leading energy resource required by Albertans. Although it is familiar to most people as home heating fuel, most gas is bound for industrial users who then market much of their end products outside the province. Examples are petrochemicals and oil sands, which together use half of all Alberta's marketable natural gas.

Figure 32 shows how each type of energy resource contributed to meeting Alberta's own requirements in 1991. The relative "draw" of each end-use sector on the province's total energy consumption is shown in Figure 33.

32. Energy Resources to Meet Alberta's End-use Requirements: 1991

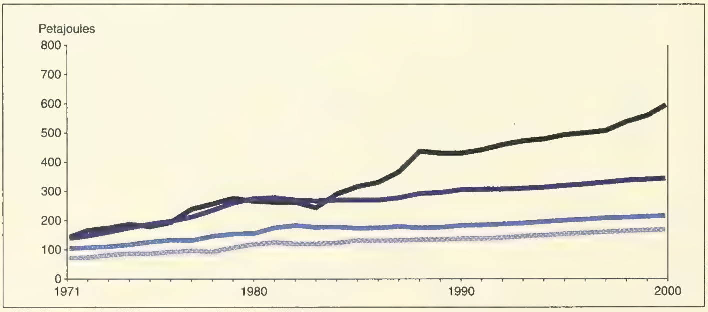


33. 1991 End-use Requirements in Alberta



34. Secondary Energy Requirements by Sector

Alberta's industrial sector includes energy-intensive operations such as petrochemicals, oil sands, and pulp and paper. Such secondary energy requirements are expected to grow by 2% annually.



In recent years, Alberta's industrial sector has been both the largest and fastest-growing economic sector. Continuing this rapid growth rate, as indicated in Figure 34, will depend on the expansion of energy-intensive industries such as oil sands, petrochemicals, and forest products.

The remaining three sectors of the province's economy are expected to experience a lower rate of growth, reflecting improvements in energy efficiency by consumers, balanced against a projected growth in provincial population.

Alberta in the Canadian energy picture

Of all the energy produced in Canada, two-thirds comes from Alberta (see Figure 36). The province is not a major source of hydroelectricity and does not produce nuclear power.

Reserves are also an important indicator of future trends. In 1991, Alberta's hydrocarbon reserves accounted for 67 per cent of Canada's total, as Figure 35 indicates. Alberta's share of petroleum reserves—that is, everything except coal—is more than 90 per cent of Canada's total. Also, the province's petroleum reserves generally are more accessible and less costly to produce than those of the far north and Atlantic offshore.

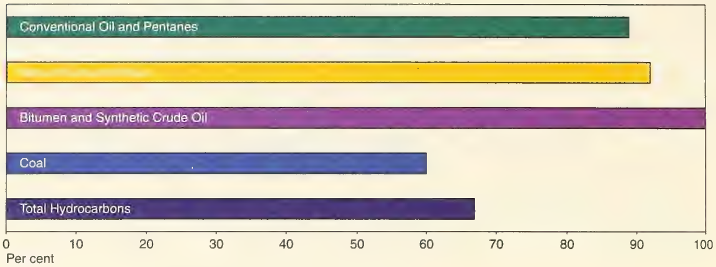
Changes in Alberta's traditional energy production patterns are well under way. For example, production of light-medium crude oil peaked in 1973 and has declined by almost half since that time. As of 1990, Alberta crude oil no longer supplies Montreal refineries. As Figure 37 indicates, this decline is projected to continue.

In the past, rising production of heavy oil and synthetic crude oil largely offset falling light production. Oil sands developments offer the prospect of preventing—or at least alleviating—a sharp decline in Alberta's total liquid hydrocarbon production. This forecast also appears in Figure 37.

In contrast to oil, whose production is limited by shrinking supplies, Alberta has sufficient natural gas reserves to support increases in production for many years. As shown in Figure 38, forecasters expect that natural gas will be an important source of energy well into the next century.

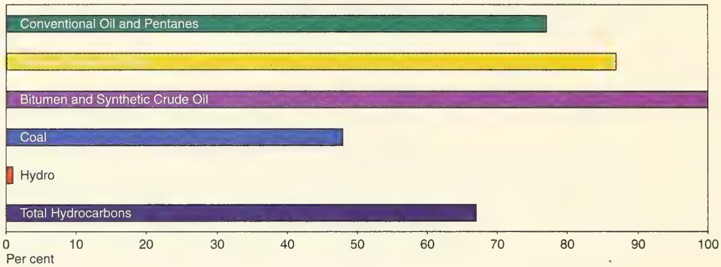
35. Alberta's Proportion of Canada's Energy Reserves

With 67% of Canada's total fossil fuel reserves, Alberta will remain an important future energy supplier.



36. Alberta's Proportion of Canada's Marketable Production

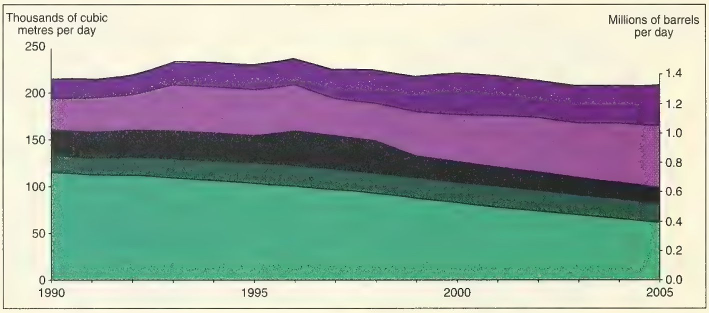
Of all the marketable energy produced in Canada in 1991, Alberta was the source of 77% of the oil, 87% of the gas, and 100% of the bitumen and synthetic crude oil.



37. Oil and Equivalent Supply to 2005

The ERCB's 1991 energy requirements forecast indicated that oil sands will be important in making up for declining conventional oil supplies over the next 15 years.

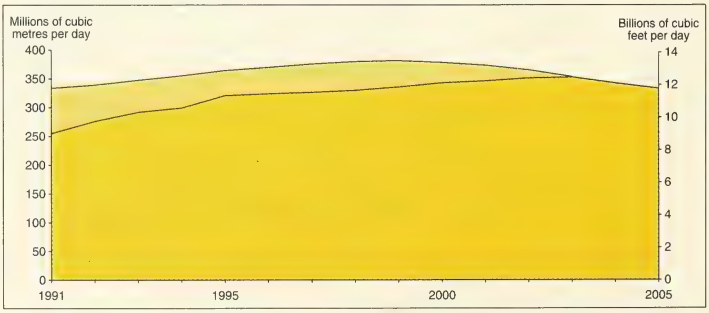
- ■ Bitumen
- ■ Synthetic Crude Oil
- ■ Heavy Oil
- ■ Pentanes Plus
- ■ Light and Medium Oil



38. Gas Capacity and Production to 2005

Alberta's supplies of natural gas are expected to peak in about a decade.

- ■ Capacity
- ■ Production



ERCB Operations

The ERCB plays a pivotal role in the development of Alberta's energy resources. In this section, we provide a brief sketch of how the ERCB operates, its responsibilities, and what ERCB people were doing during 1991.

Staffing and expenditures

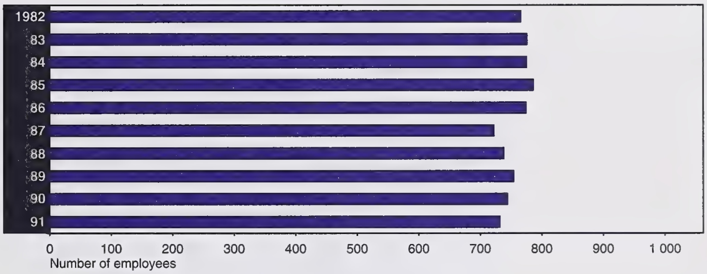
The ERCB employs professionally qualified and experienced people located in its Calgary head office, Chemical Laboratory, and Core Research Centre, and in 8 area offices throughout the province. During 1991, the ERCB consisted of 5 Board Members and an Executive Manager—Operations, supported by 732 employees in 17 departments.

Funding for the ERCB comes from two sources in about equal portions: a direct grant from the provincial government, and revenues from an administrative levy on operating oil and gas wells in the province. The total cost of ERCB operations in 1991 was $43 million.

39. ERCB Staff

The ERCB's employee count decreased from 745 in 1990 to 732 this year.

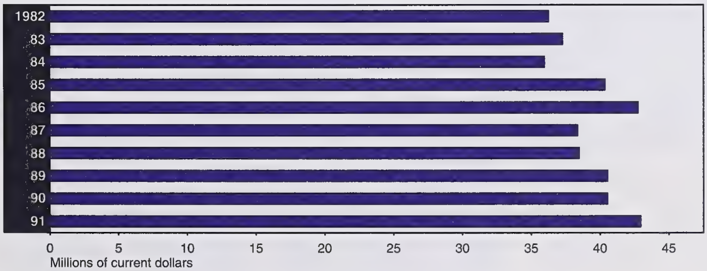
■ Employees



40. ERCB Expenditures

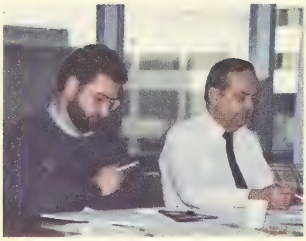
Funding for the ERCB's $43 million budget in 1991 came from two sources: a provincial grant and a levy on producing oil and gas wells.

■ Dollars



ERCB responsibilities

As part of its new Quality Management and Service program (see story on pp 3-6), the ERCB identified 7 core responsibility areas for improvement. To give the reader a sense of the challenge the ERCB is facing in the next decade as we strive to serve Albertans more effectively and efficiently, we share with you the scope of regulatory work handled by our people in a typical year:



Typical of ERCB involvement with government is Gas Department's Larry Mazurek (r). Here he works with Alberta Energy's Greg Sannes on an Integrated Resource Plan for the Eastern Irrigation District.

Application review process

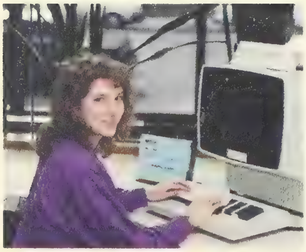
- the ERCB reviewed almost 13 000 applications in 1991, including 4090 to drill wells, 2030 for production facilities, 4923 for pipelines, 319 related to gas plants, 430 permits to remove natural gas, 67 electric projects, 32 coal projects, 31 oil sands facilities and about 960 for other oil- and gas-related purposes
- only 21 applications resulted in hearings in 1991, down from more than 80 in the mid-1980s

Legislation and regulation

- the work of the ERCB is governed by 8 provincial Acts and hundreds of requirements in the regulations that accompany these Acts
- new or additional requirements, not yet in ERCB legislation, are set out in a total of 166 Informational Letters (ILs) and Interim Directives (IDs)
- the ERCB published 18 new ILs and IDs in 1991

Advice to government

- ERCB regulations affect or are affected by the legislation of many government departments and agencies, most notably Alberta Environment, Energy, Forestry, Lands and Wildlife, and Municipal Affairs



The ERCB's inventory of raw energy data is immense. For example, Information Services' Gloria Pedersen can provide customers with complete production data for any Alberta well.

Data acquisition and dissemination

- the ERCB has one of the largest inventories of raw energy resource data in the world, most of it publicly accessible
- the ERCB Library handles about 16 000 service requests annually, 65 per cent of which originate from outside the organization
- the ERCB's Information Services Section houses 140 000 well records and more than 100 regulatory publications and maps
- the ERCB's Core Research Centre houses 10 million vials of drill cuttings and 1200 kilometres of core
- 25 000 visitors toured the Energeum, the ERCB's energy science centre, in 1991, half of these as part of organized educational programs

Resource and market appraisal

- the ERCB's evaluation of reserves is crucial in determining broad economic policy and industry investment decisions
- the ERCB regularly reports on trends in requirements for Alberta's energy resources

Responding to complaints and concerns

- public complaints are a top priority for field staff; ERCB inspectors responded to 937 complaints from landowners, residents, and special interest groups in 1991
- by year-end, field staff had completed 100 formal presentations and 700 visits to residents to explain the role of the ERCB
- the number of applications that result in hearings has decreased dramatically in the past 5 years, mostly because of effective mediation measures to deal with landowner concerns

Inspections and enforcement

- field staff made more than 20 000 site inspections during the year, including drilling and service rigs, oil and gas wells, gas plants, pipelines, and oil batteries

The ERCB head office—housed in this building since 1980—has been part of Calgary's energy community since 1938.

ERCB Management Team

Board Member

F. J. Mink	Vice Chairman
J. P. Prince	Vice Chairman
N. G. Berndtsson	
B. F. Bietz	
R. G. Evans	

Executive Manager—Operations
J. D. Dilay

Departments

Accounting	R. T. Bording
Administrative Services	K. G. Pippard
Coal	R. G. Paterson
Communications	J. K. Bales
Data Processing	L. D. Fredlund
Drilling and Production	J. R. Nichol
Economics	J. W. Newton
Employee Relations	R. F. Braun
Environment Protection	H. O. Lillo
Field Operations	W. G. Remmer
Gas	H. R. Keushnig
Geology	C. A. Langlo
Hydro and Electric	T. F. Homeniuk
Legal	M. J. Bruni
Oil	R. A. Purvis
Oil Sands	R. N. Houlihan
Pipeline	K. G. Sharp

Continuous Improvement Coordinator
W. J. Schnitzler

Additional information on the ERCB and its activities can be obtained from:

Information Services	(403) 297-8190
Library	(403) 297-8242
Communications	(403) 297-4601

All three information sources are located in the ERCB head office at 640 - 5 Avenue S.W., Calgary, Alberta, T2P 3G4

ERCB

As always, we welcome your input to this publication.
Please contact:
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